COLORADO
Energy Office

PROJECT NATURAL RESOURCES COLORADO
REPORT 2016

Prepared for Colorado Energy Office

by McREL International

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About Colorado Energy Office
The Colorado Energy Office works to improve the effective use of all of Colorado's energy resources and the efficient consumption of energy in all economic sectors that benefit the economic and environmental health of the state. Visit the website at www.colorado.gov/energy.

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About McREL
McREL International is a nonprofit, nonpartisan organization dedicated to improving education outcomes for all students through applied research, product development, and professional service to teachers and education leaders across the U.S., in Australia, and in the Pacific Region.

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Key Findings

Goal 1 - Describe the CO educational system as it relates to high schools, including charter, magnet, and private schools.

According to the National Center for Education Statistics (NCES) data, 2013-14 data, Colorado has 493 public schools that serve grades 9-12, of which 70 are charter, and four are magnet. According to the 2011-12 data, Colorado has 97 private schools.

Goal 2 - Understand high school level current offerings of and interest in offering natural resources and energy educational offerings (both online and in the classroom).

Internet searches and interviews highlighted the fact that courses with natural resources content for high schools are offered via Advanced Placement (AP) science courses, with the highest student enrollment in AP Biology. Professional development for natural resources education is available, although not consistently, via organizations, universities, and industry partnerships. A number of factors including school district size, availability of teachers interested in natural resources education, availability of teaching materials for natural resources courses, and vicinity of the school to a natural resources industry determine the course offering at the school. Principals in Colorado high schools indicated, via their responses to a survey, that they have an interest in offering energy- and natural resources-related courses, mostly as supplements to existing courses in their schools, although few principals expressed an interest in purchasing such courses. Online courses are offered in core courses of Biology, Chemistry, and Earth Science. Environmental Science is also offered online. Technological capacity to offer online courses in traditional and blended schools is sound, but few indicate the willingness to offer energy- and natural resources-related courses online.

Goal 3 - Describe the status of online course offerings for high school students and the accreditation

Utilizing the Colorado Department of Education's (CDE) list of online schools and programs currently offered in Colorado, McREL examined the information from 32 online schools and programs focusing on energy- and natural resources- related courses offered by these high schools and high school student-age focused programs. The spectrum of such courses shows that the energy and natural resources content are embedded in the core courses and are also being offered through STEM elective and Environmental Science courses. Programs and schools which provided information about accreditation on their website mentioned being accredited by organizations such as AdvancED, CDE, regional accrediting organizations like the Council for Higher Education Accreditation, and the United States Department of Education.

Goal 4 - Understand the policies of charter schools related to curriculum selection and use of online learning.

The policies and practices related to choosing and/or modifying curricula in charter schools in Colorado are dependent on adhering to the mission, vision, and budget considerations of the school. While the governing board makes the final approval of new curriculum selection or major modification to existing curriculum, the selection process is held by the director of curriculum and instruction, the chief academic officer, and a business manager for large charter schools and by the principal and business manager for small charter schools. The curriculum approval process at charter schools involves data-driven decision making processes. Charter schools gather information about curriculum of interest through collaboration with other charter schools, contacting the vendors directly, and also connecting with the Colorado League of Charter schools as a resource. Online courses in charter schools tend to be offered as electives and the extent of online learning in charter schools is varied.

Application of Results to Practice

Colorado has vested economic interest in energy and natural resources, but schools have incorporated such education to a limited extent. Schools showed interest in supplementing current materials with energy and natural resources content but did not appear to financially prioritize their inclusion. Because district and school budgets are limited, other sources of increasing systematic availability of professional development and materials for teachers interested in teaching energy and natural resources-related courses may be beneficial to schools interested in offering these courses. Online schools and programs are offering such content in core courses while also offering the content in STEM electives and Environmental Science courses suggesting a venue for additional energy- and natural resources-related content. If Colorado's economy demands a larger workforce of energy and natural resources professionals, then it is logical to want to increase the interest of the next generation of workers in energy and natural resources. If Colorado's public schools are not offering content that may spark the interest of students in these areas, then it is less likely that they will explore potential careers in energy and natural resources and thus, less likely that the next generation of workers in Colorado will be vested in supporting Colorado's economic interests in energy and natural resources.

Introduction

McREL International (McREL) was contracted by the Colorado Energy Office (CEO) to provide a research report on Science Technology Engineering and Math (STEM) education across Colorado's secondary education institutions with a focus on how it addresses natural resources and energy workforce needs. This research report provided by McREL addresses the following four goals:

1. Describe the CO educational system as it relates to high schools, including charter, magnet, and private schools.
2. Understand high school level current offerings of and interest in offering natural resources and energy educational offerings (both online and in the classroom).
3. Describe the status of online course offerings for high school students and the accreditation process.
4. Understand the policies of charter schools related to curriculum selection and use of online learning.

McREL utilized online searches, reviews of secondary data, surveys, and interviews to address the goals. Results from each of the goals are presented in this report.

Goal 1

Overview

Goal 1 of Project Natural Resources is to describe the demographic characteristics of Colorado schools at the secondary level, including public high schools, charter and magnet high schools, and private high schools.

Methods

Database Search

McREL International used data available on the National Center for Education Statistics (NCES) website to create tables for all public and private schools in Colorado. The latest NCES data available is from 2013–14 for public schools and 2011–12 for private schools. McREL also searched the Colorado Department of Education (CDE) website for relevant data, but NCES provided more comprehensive information for the purpose of this report and, hence, is the data source for the tables below.

Findings

Tables 1–4 presented below display the demographic characteristics of Colorado schools by locale (i.e., city, suburb, town, and rural). Twelve locale categories provided by NCES were aggregated to create the four major categories shown here.[1] Excel worksheets used to calculate the numbers and percentages are attached. A codebook is provided to explain the definitions as a tab in each sheet. An additional tab provides the notes regarding the data. Only schools that serve at least one 9–12 grade are included in the calculations. The percentage of students receiving free or reduced-priced lunch (FRL) is calculated as

$$\% \text{ FRL} = \frac{\text{Sum of all FRL students in a locale}}{\text{Sum of all students with highest grade nine or above}}$$

[1] City and Suburb: Large, midsize, and small locales were aggregated. Town and Rural: Fringe, distant, and remote locales were aggregated.

Table 1. Demographics for All Colorado Public Schools, 2013–14

Locale	Number of schools	Number of virtual schools	FRL students n (%)	Grades 9–12 students (n)	Grade 9 students n (%)	Grade 10 students n (%)	Grade 11 students n (%)	Grade 12 students n (%)	Overall male grades 9-12 (%)	Overall female grades 9–12 (%)
City	154	8	49637 (45%)	94815	25087 (26%)	23910 (25%)	21891 (23%)	23927 (25%)	51%	49%
Suburb	114	10	30561 (29%)	93012	23629 (25%)	23074 (25%)	22484 (24%)	23825 (26%)	51%	49%
Town	62	6	9049 (39%)	22205	5802 (26%)	5495 (25%)	5439 (24%)	5469 (25%)	51%	49%
Rural	163	8	13480 (29%)	39216	10214 (26%)	10007 (26%)	9445 (24%)	9550 (24%)	52%	48%
Total	493	32	102727 (36%)	249248	64732 (26%)	62486 (25%)	59259 (24%)	62771 (25%)	51%	49%

Table 2. Demographics for All Colorado Charter Public Schools, 2013–14

Locale	Number of schools	Number of virtual schools	FRL students n (%)	Grades 9–12 students (n)	Grade 9 students n (%)	Grade 10 students n (%)	Grade 11 students n (%)	Grade 12 students n (%)	Overall male grades 9–12(%)	Overall female grades 9–12 (%)
City	37	0	7386 (43%)	9222	2617 (28%)	2338 (25%)	2072 (22%)	2195 (24%)	49%	51%
Suburb	24	4	5316 (29%)	8719	1822 (21%)	1830 (21%)	2056 (24%)	3011 (35%)	48%	52%
Town	4	0	285 (30%)	647	138 (21%)	128 (20%)	172 (27%)	209 (32%)	55%	45%
Rural	8	0	595 (33%)	1475	415 (28%)	383 (26%)	277 (19%)	400 (27%)	60%	40%

All charter schools	73	4	13627 (36%)	20063	4992 (25%)	4679 (23%)	4577 (23%)	5815 (29%)	49%	51%

Table 3. Demographics for All Colorado Magnet Public Schools, 2013–14

Locale	Number of schools	Number of virtual schools	FRL students n (%)	Grades 9–12 students (n)	Grade 9 students n (%)	Grade 10 students n (%)	Grade 11 students n (%)	Grade 12 students n (%)	Overall male grades 9–12 (%)	Overall female grades 9–12 (%)
City	1	0	400 (52%)	406	140 (34%)	101 (25%)	84 (21%)	81 (20%)	43%	57%
Suburb	2	0	553 (66%)	317	63 (20%)	67 (21%)	49 (15%)	138 (44%)	52%	48%
Rural	1	1	0 (0%)	69	5 (7%)	17 (25%)	17 (25%)	30 (43%)	57%	43%
All magnet schools	4	1	953 (57%)	792	208 (26%)	185 (23%)	150 (19%)	249 (31%)	48%	52%

Note. Statistics for the "Town" category are not available from NCES for magnet public schools.

Table 4. Demographics for All Colorado Private Schools, 2011–12

Locale	Number of schools	Grades 9–12 students n	Grade 9 Students n (%)	Grade 10 Students n (%)	Grade 11 Students n (%)	Grade 12 Students n (%)
City	37	5227	1344 (26%)	1329 (25%)	1312 (25%)	1242 (24%)
Suburb	31	3521	916 (26%)	946 (27%)	844 (24%)	815 (23%)
Town	10	252	55	59	69	69

Locale	Number of schools	Grades 9–12 students n	Grade 9 Students n (%)	Grade 10 Students n (%)	Grade 11 Students n (%)	Grade 12 Students n (%)
			(22%)	(23%)	(27%)	(27%)
Rural	19	1715	455 (27%)	423 (25%)	415 (24%)	422 (25%)
All private schools	97	10715	2770 (26%)	2757 (26%)	2640 (25%)	2548 (24%)

Note. Statistics for free and reduced lunch students, virtual schools, and gender are not available from NCES for private schools.

Conclusion

According to the NCES data, 2013–14 data, Colorado has 493 public schools that serve grades 9–12, of which 70 are charter, and four are magnet. According to the 2011–12 data, Colorado has 97 private schools.

Goal 2, Part I

Overview

Goal 2, Part I of the Natural Resources Project is to examine the learning opportunities currently available to high school students and the professional development (PD) opportunities currently available to high school teachers related to natural resources. This information was gathered through Internet searches and interviews with staff from select education organizations. The sections below address the methods used and the findings.

Methods

Internet Searches and Review of Advanced Placement (AP) Curricula

McREL utilized the CDE website and Google to search for courses in Colorado for both high school students and teachers that include natural resources content. McREL also used data from CDE to look at AP courses related to natural resources that are offered in Colorado schools.

Interviews

Phone interviews were conducted with staff from the following organizations: Colorado Community College System (CCCS), CDE, and Colorado Association of School Executives (CASE). McREL interviewed one individual from CCSS and CASE and two individuals from CDE. Prior to the interviews, the purpose of the interviews and the interview questions were emailed to these individuals. Then McREL researchers contacted the interviewees to schedule the interviews at a time that was most convenient for them. The four interviews were conducted March 16 and 17, 2016, and each interview was approximately 30 minutes in duration.

Protocol

The interview protocol was developed by McREL. It included questions on K–12 approaches to natural resources education, the content of these courses, the PD available to teachers, out-of-school time courses for Colorado high school students, the accreditation process, interest among schools in Colorado for purchasing natural resources courses/curriculum, staffing and technological capacity to offer online courses, and policies and practices of Colorado schools related to choosing curricula. See Appendix C for more on the interview protocol.

Findings from Internet Searches

The CDE maintains on their website a list for teacher PD in science. A current list of the organizations offering teacher PD in Colorado and nationally is listed in Appendix A. Within this list, organizations that provide PD specific to natural resources are: the Citizen Science Academy, National Renewable Energy Laboratory (NREL), and Colorado School of Mines. Citizen Science Academy is an online PD resource for teachers to support effective implementation of projects and activities focusing on ecology and environmental sciences. The NREL Energy Institute for Teachers provides workshops to teachers and offers lessons and resources that integrate renewable energy and energy efficiency components into existing courses in science. Colorado School of Mines offers teacher PD through its Teacher Enhancement Program, part of the Office of Special Programs and Continuing Education. The 2016 spring and summer courses listed on the Colorado School of Mines website indicate a broad range of topics, including environmental impact research, mining, environmental education conferences, and ecological importance of floods among others (see http://te.csmspace.com/register.php for a complete list).

Another part of Goal 2 is to examine current AP science curricula available and whether natural resources are covered as part of these curricula. McREL used data from CDE as well as an Internet search to examine AP courses related to natural resources that are offered in Colorado schools. The Internet search revealed that, in Colorado public schools, AP science courses are offered in biology, chemistry, environmental science, and physics.

According to the College Board website, students in AP Biology "learn about the core scientific principles, theories, and processes governing living organisms, biological systems, and natural phenomena." Students in AP Chemistry learn about "the fundamental concepts of chemistry such as structure and states of matter, intermolecular forces, reactions, and how to use chemical calculations to solve problems." In AP Environmental Science, students "explore and investigate the interrelationships of the natural world, identify and analyze environmental problems, both natural and human-made, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving and/or preventing them." Students in Physics 1or Physics 2 "develop scientific critical thinking and reasoning skills through inquiry-based learning." Physics C Electricity and Magnetism allows students to "explore concepts such as electrostatics, electric circuits, conductors, capacitors, dielectrics, magnetic fields, and electromagnetism." Lastly, in Physics C Mechanics, students "explore concepts such as kinematics; Newton's laws of motion, work, energy and power; systems of particles and linear momentum; circular motion and rotation; oscillations; and gravitation" (The College Board, 2016). Details of the topics covered in the AP science courses is provided in Appendix B.

Table 5 presents an overview of the number of students enrolled in AP science courses and the percent of total students enrolled in all AP courses. In general, AP Biology has the most students enrolled, followed by AP Chemistry, AP Environmental Science, and AP Physics. Biology has a higher female enrollment, whereas Physics has a higher male enrollment. AP Environmental Science and AP Chemistry have approximately equal female and male enrollments within each course.

Table 5. Total Students Enrolled in AP Science Courses in All Colorado Public Schools, 2014–15

Course name	Male count	Female count	Total students enrolled in AP courses	Percent of total students enrolled in all AP courses
Biology	1,262	2,093	3,355	5.15%
Chemistry	1,433	1,204	2,637	4.05%
Environmental Science	890	1,025	1,915	2.94%
Physics B	1,021	605	1,626	2.49%
Physics C: Electricity and Magnetism	596	280	876	1.34%
Physics C: Mechanics	553	180	733	1.12%

Source: Colorado Department of Education, 2016.

Findings from Interviews

The findings presented below correspond with the topics covered in the interview protocol.

The K–12 Approach

One interviewee shared that the K–12 approach to natural resources education is probably mixed, depending on the resources that the district possesses. This interviewee explained, if the district has teachers with the knowledge to provide specialized courses like natural resources, those courses tend to go deeper into problem-based learning situations; districts that lack these resources provide basic knowledge about natural resources in the core courses. One interviewee mentioned that the teachers need more training in order to offer a balanced approach to teaching natural resources. This individual summed it up this way: "We just touch on facts and opinions, but we don't go into depth." Interviewees identified a need for effective teaching materials in order to present a balanced view of all aspects of natural resource management.

Course Landscape

Interviewees provided information on the landscape of course offerings in Colorado high schools. One interviewee explained that while some schools have specific courses geared toward natural resources, most integrate it into existing courses "only as far as what the standards demand." Large districts tend to have more teachers and, hence, can offer more specialized type courses. This interviewee elaborated that natural resources content is usually embedded in other courses as units of instruction, and the course offerings are in specialized contexts. Another interviewee added that full-fledged courses are not common in schools. Natural resources are offered in small schools only when it might be relevant to their community (e.g., school is near a coal mine) and are offered as electives because the school focuses on the core subjects (that are needed to enter postsecondary education (e.g., biology, physics, chemistry). One interviewee mentioned that there are programs in renewable energy in more than 100 schools in Colorado, but these are nascent and only four or five of those are teaching full courses in energy. Another interviewee mentioned that some natural resources courses are offered through the concurrent enrollment program, which provides high school students an opportunity to take college-level courses and currently includes 25,000 high school students across Colorado. Content in these courses is determined by district administrators, principals, AP teachers, and school counselors.

Sources of Support

The interviewees shared several examples of organizations and programs that provide support for high school teachers in Colorado. Local industries (e.g., mining) and universities often provide PD in natural resources. One interviewee indicated, however, that such PD is not consistent and availability depends on funding. Some organizations, like the American Geosciences Institute, have continual funding, but others do not. This interviewee also shared that, at the state level, annual PD is available for teachers through nonprofit organizations like the Colorado Association of Science Teachers. National-level organizations mentioned were the National Association of Science Teachers, Khan Academy, National Aeronautics and Space Administration, National Association of Research and Science Teaching, and National Science Foundation. One interviewee shared that the Colorado School of Mines provides teacher PD, and some energy companies offer summer internships for teachers. One interviewee noted that a teacher in her school district participated in a summer camp offered by a local industry and then returned to school and provided PD in natural resources to the other teachers in her school. This teacher was also able to get continuing education credits for the PD she attended.

Accreditation

According to the interviewees, students get college credit if they are enrolled in concurrent classes or if they are enrolled in an AP class and pass the AP final exam with a score of three or better (this varies depending on the institution of higher education). One interviewee elaborated that high school level courses aren't accredited; rather, the districts have accreditation and determine which courses to offer. This respondent added that the AP curriculum is dictated by the College Board and that, to get more information for higher education course accreditation, the Higher Learning Commission and the Department of Higher Education might be good

resources. Interviewees highlighted that elective courses tend to be junior-senior level, and natural resources courses are usually electives. Elective and core courses have the same credits and are decided by the local school board.

Interest in Purchasing Curricula

All interviewees indicated that educators are focused on ensuring that students are ready to enter the workforce after high school. They also indicated that the state of Colorado has high vested economical interest in natural resources and that, in the words of one interviewee, "We would be doing a disservice to our state if we're not providing a solid understanding of this aspect to all of our students coming to school." Another interviewee noted that there is a strong emphasis across the state on offering STEM classes and that natural resources can be "nicely tied in" with those courses. Another interviewee added that large school districts are less likely to purchase "lock-step type curriculum" and, rather, tend to purchase resources that help support their existing curriculum. One interviewee summarized it this way: "Natural resources are at the heart of economic development across the state; therefore, . . . if that curriculum was available, more districts and schools will use it."

Staffing and Technological Capacity for Online Learning

All but one interviewee mentioned that the state of Colorado currently lacks the staffing and technological capacity to provide online courses. They added that adequate staffing and addressing technological needs is on the radar of schools and is improving, but most districts across the state "are not there yet." The lack of capacity was noted as originating from inconsistent Internet access, especially in rural communities. One interviewee noted that while online education is an effective means to understand content, many students learn best with hands-on learning opportunities. One of the interviewees did not have knowledge about staffing and technological capacity for Colorado schools.

Curriculum Selection

All interviewees shared that Colorado is a local control state, meaning that each district in Colorado has its own policies and procedures to adopt their curriculum and "they all do it differently." CDE does not promote specific curricula; however, they do provide resources that help guide schools in selecting curricula. For example, CDE can provide a sample curriculum created by teachers across the state that gives overviews of Colorado standards. As far as processes for selecting environmental curricula, one interviewee noted that schools don't have specific natural resources curricula; instead, they look at the standards that they need to cover and then select a curriculum that covers those standards. The process involves the decision making of high school committees and is also reliant on the availability of personnel interested to teach the natural resources curriculum.

Additional Comments

Interviewees were given the opportunity to provide additional comments. Comments included affirmation that natural resources management is a large part of the Colorado economy and needs to be addressed by providing students and teachers with a solid understanding of natural resources and management of the resources through courses and information. The needs of the community can also be met by forging partnerships between business and education.

Conclusion

Internet searches and interviews revealed that Colorado has vested economic interest in natural resources, and schools have incorporated natural resources education to an extent, but not to the extent that is desired to prepare the workforce needed by the energy and natural resources industry. Courses in natural resources for high school

students are offered via AP science courses and content related to natural resources is also integrated in existing courses. Whether a natural resources course is offered as a core course, an elective, or embedded in existing courses depends on myriad factors, such as size of the school district, availability of teachers who have an interest in natural resources, availability of instructional materials, and vicinity of the school to a natural resources industry. PD in natural resources education is available, although not consistently, for teachers via organizations, universities, and industry partnerships. These findings demonstrate needs for more funding, the preparation of pre-service teachers, and more awareness about the importance of natural resources to the economic growth of Colorado and the education of Colorado youth.

Goal 2, Part II

Overview

Goal 2 of the energy and natural resources project is to understand current natural resources educational offerings (both online and in the classroom) for high school students and interest in offering them. As part of Goal 2, McREL conducted internet searches and interviews. This section focuses on Goal 2, Part II, which involved conducting a survey of all principals in Colorado to examine whether their schools offer natural resources education and if they have interest in offering it.

Methods

Sample

McREL launched a survey to all principals in Colorado. The survey was administered on April 14, 2016 and closed on April 28, 2016. Three reminders were sent to the principals who did not respond to the initial survey request. One school district declined to participate and was removed from the distribution list. A total of 1498 principals were sent the survey and 82 principals completed the survey for a response rate of 5%.

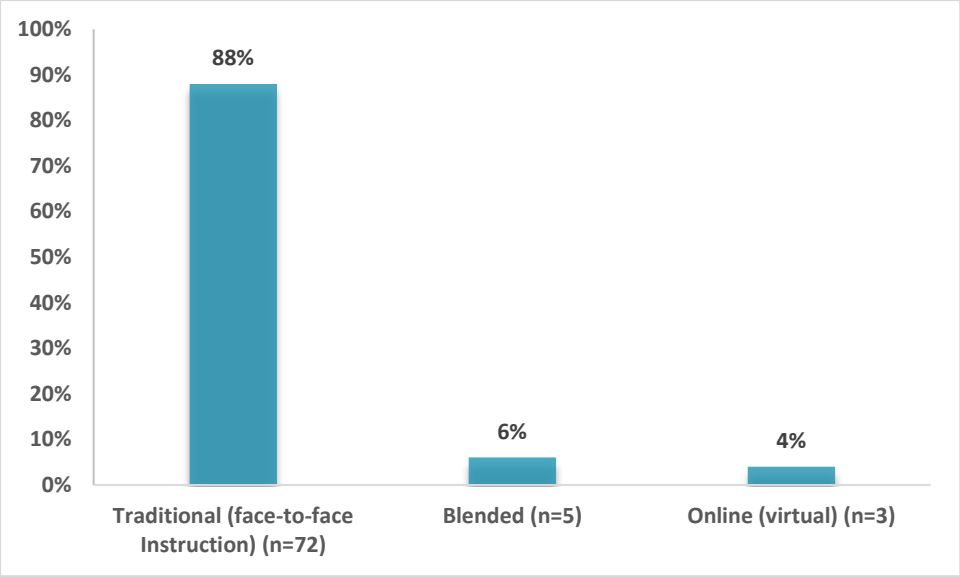
Instrument

The principal survey was developed by McREL. It included survey items related to high schools including: type and focus of school, status of course offering, PD, elective and /or out-of-school time identification of the courses, interest and technological capability of schools in offering the courses, grade level and college credit status for the courses, online status of the courses, awareness of the Colorado Green Ribbon award, and curricula approval and selection. See Appendix D for the principal survey. Prior to collecting any data, institutional review board approval was received.

Findings from Principal Survey

After data cleaning, a total of 82 complete responses were retained. A response was deemed complete, if at least one survey item was answered. The first survey item asked the principals to identify their school type. A majority of schools were identified as traditional, as seen in Figure 1 (see next page).

Figure 1. Respondent Colorado High School Type (*n* = 80)



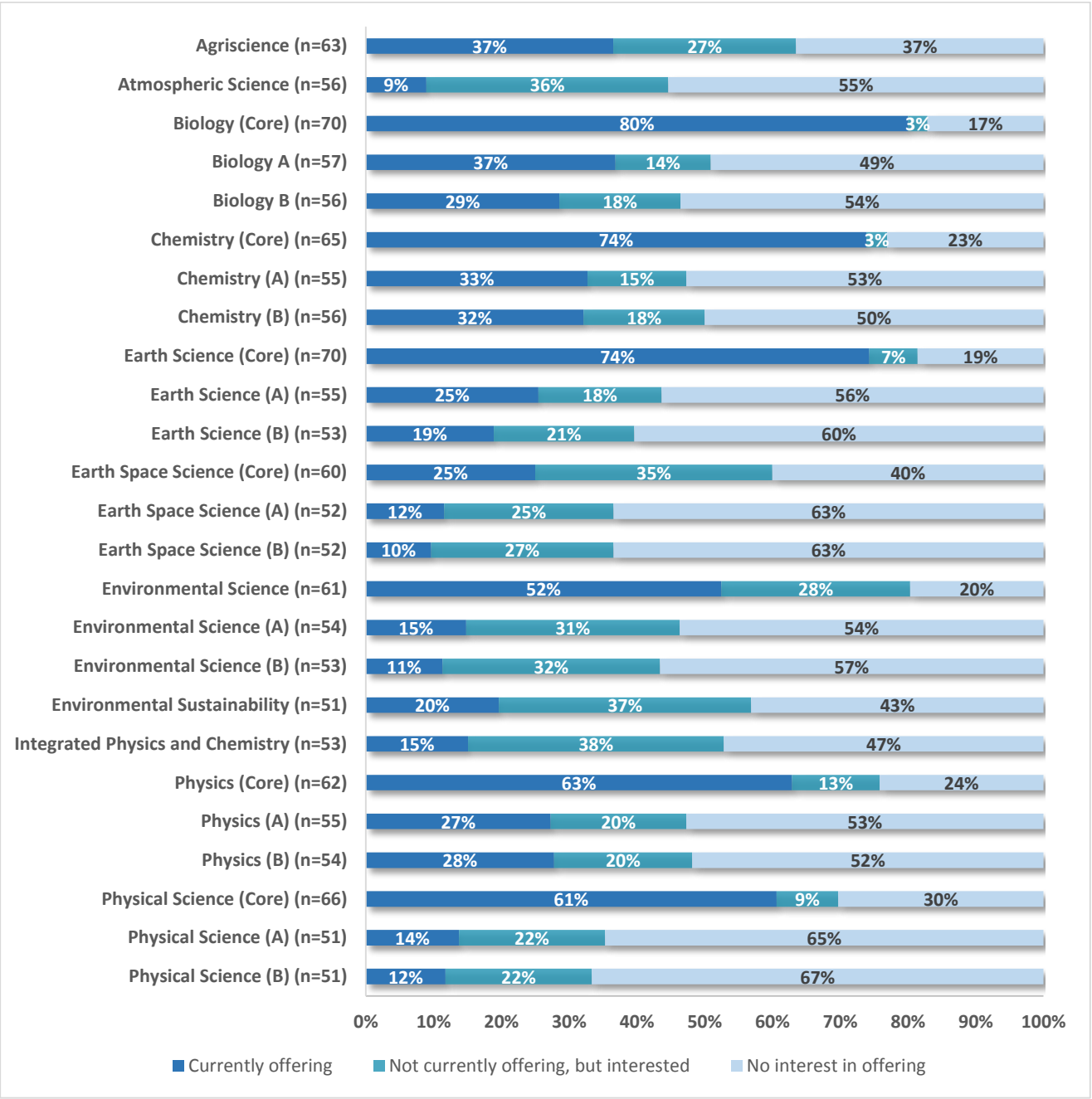
Note. Two respondents did not indicate high school type.

Further, principals were asked to identify whether their school is public, public charter, public magnet, private, neither charter nor magnet, or any other. All 78 schools that responded identifed as as public.

When asked whether their school had a Science, Technology, Engineering, and Math (STEM) focus, a majority of principals replied "no" (77%).

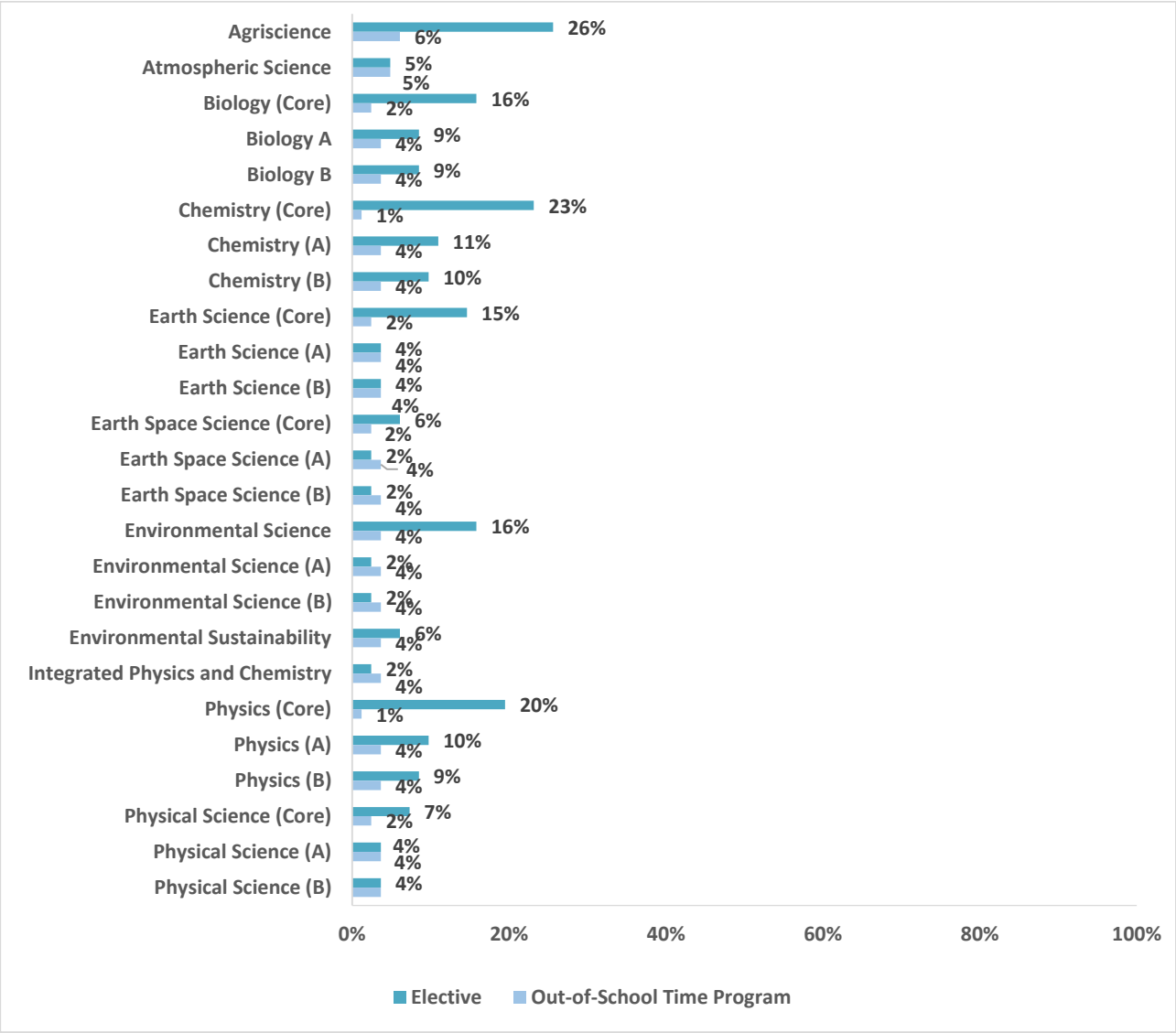
Next, principals were provided with a list of energy and natural resources-related courses and asked to indicate the status of each course (i.e., "currently offering", 2 being "not currently offering, but interested," and 3 being "no interest in offering"). As displayed in Figure 2 (see next page), at least 30% of principals identified the following courses as "not currently offering, but interested": Atmospheric Science, Earth Space Science (core), Environmental Science A, Environmental Science B, Environmental Sustainability, Integrated Physics and Chemistry. These courses are currently offered at a lower percentage, between 9–25%, in the schools and suggests a need for such courses within public high schools in Colorado.

Figure 2. Status of Energy and Natural Resources-Related Courses, by Percentage of Schools



For the same courses, principals were asked to identify whether a course was offered as an elective and/or an out-of-school time program. This item was answered by principals who selected, "currently offering" in the preceding item. A majority of the 25 courses listed were identified as mostly being offered as electives (Figure 3).

Figure 3. Percent of Schools Offering Natural Resources-Related Courses, by Course and Format



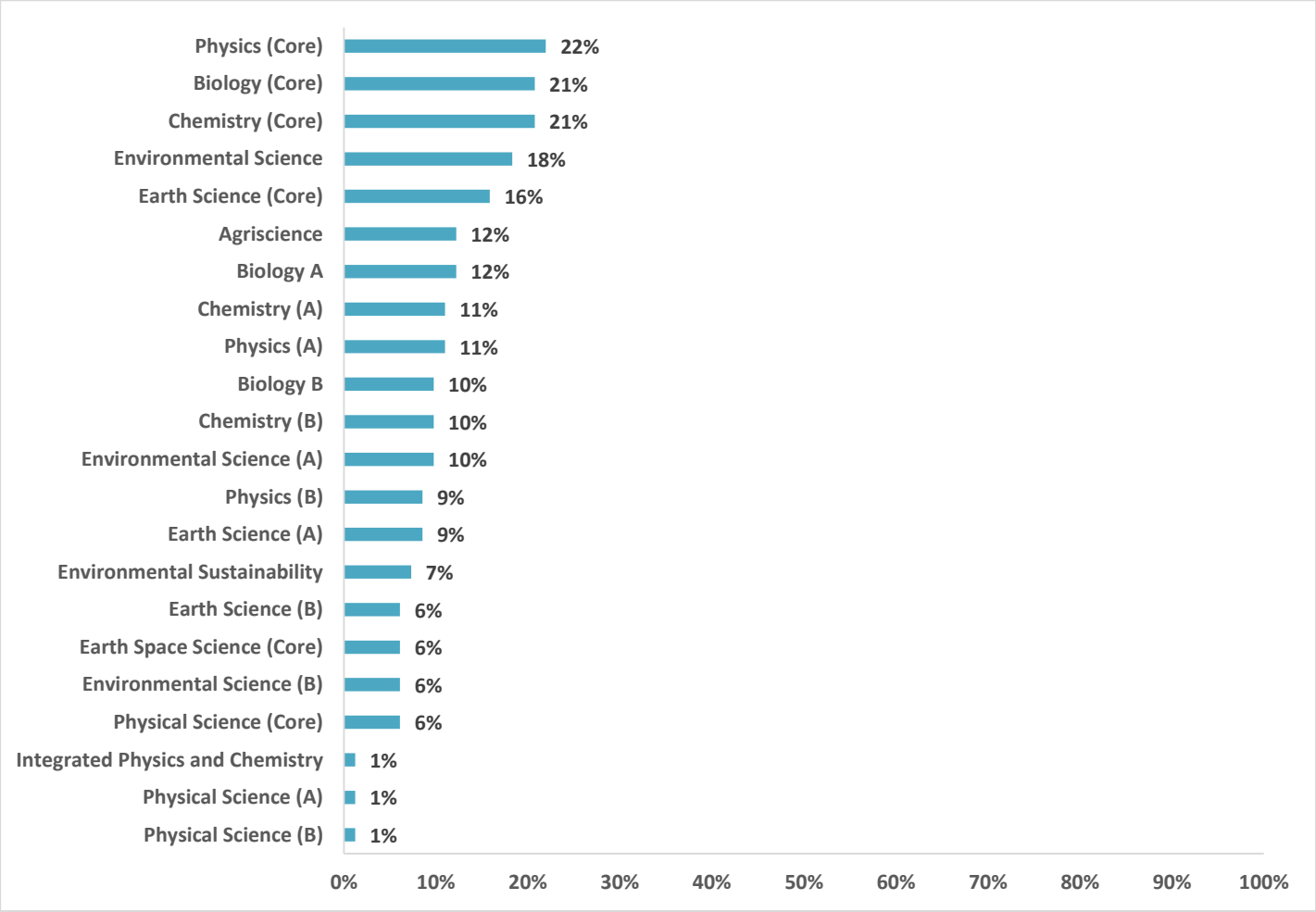
Note. Principals could select more than one answer choice for this survey item.

Principals were asked to list any other energy and natural resources-related courses not listed in previous survey items in which they were currently offering in their schools. In their open-ended comments 6 principals identified the following courses: Engineering, applied science, Mathematics Engineering Science Achievement (MESA) after school grade level classes, honors biology with emphasis in renewable energy, physics and earth science with emphasis in renewable energy, design thinking, and alternative energy. One principal noted that all the energy and natural resources-related courses at his/her school are taught within the grade-level science curriculum.

To find out whether teachers were being provided PD for energy and natural resources-related courses, principals were provided the same list of courses as above and asked to identify all courses at their school for which teacher PD is provided (Figure 4). Although some PD is being provided at public high schools in energy and natural

resources-related courses, the PD is provided mostly for the core courses of Physics (22%), Biology (21%), and Chemistry (21%). Atmospheric science, Earth Space Science A and Earth Space Science B were not being offered teacher PD.

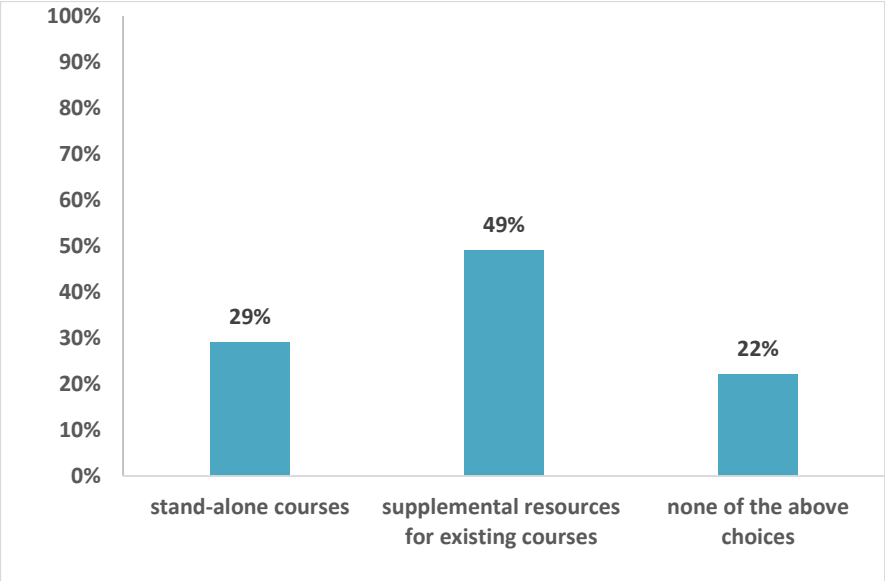
Figure 4. Percent of Schools That Provide Teacher PD, by Course



Note. Principals could select more than one answer choice for this survey item.

Principals were asked whether they were interested in providing additional courses related to energy and natural resources at their schools. Principals were mostly interested in providing such courses as supplemental resources for existing courses (Figure 5).

Figure 5. Principal Interest in Providing Energy and Natural Resources-Related Courses (*n* = 69)

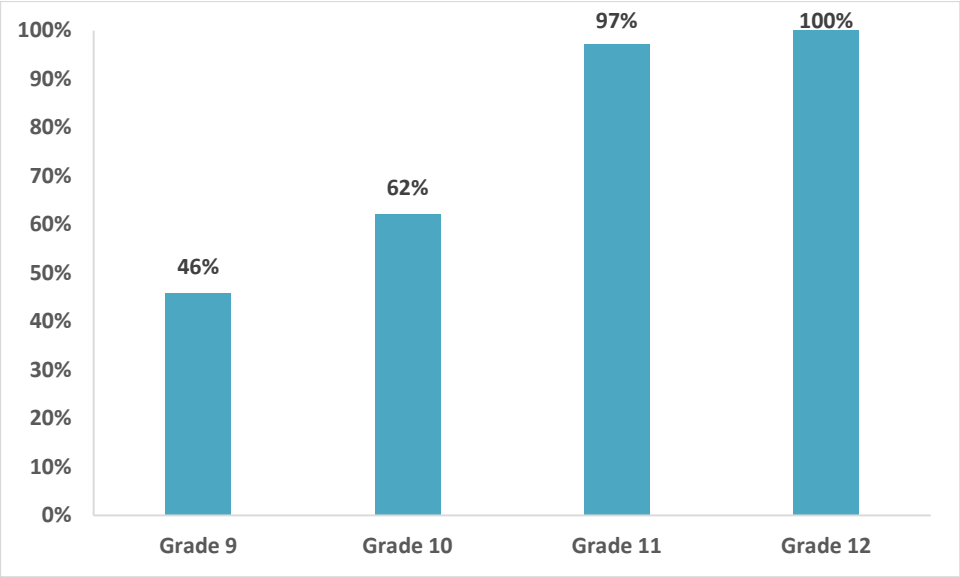


The next survey item asked principals whether their school would be willing to purchase any of the energy and natural resources-related courses which they find interesting. Only 20% of the principals replied in the affirmative indicating that although there is interest in such courses, providing funds to purchase such courses for the school might be challenging.

Principals who selected "blended" or "traditional" earlier in the survey were asked if their schools offered online courses. A majority (54%) of the principals replied "yes."

For all online courses offered in blended, traditional, or virtual schools, principals were asked to identify the high school grade levels at which their school offered online courses. As seen in Figure 6, most online courses are offered in grades 11 and 12 while a lesser number on online courses are offered in grades 9 and 10.

Figure 6. Percentage of Schools That Offer Online Courses, by Grade (*n* = 37)

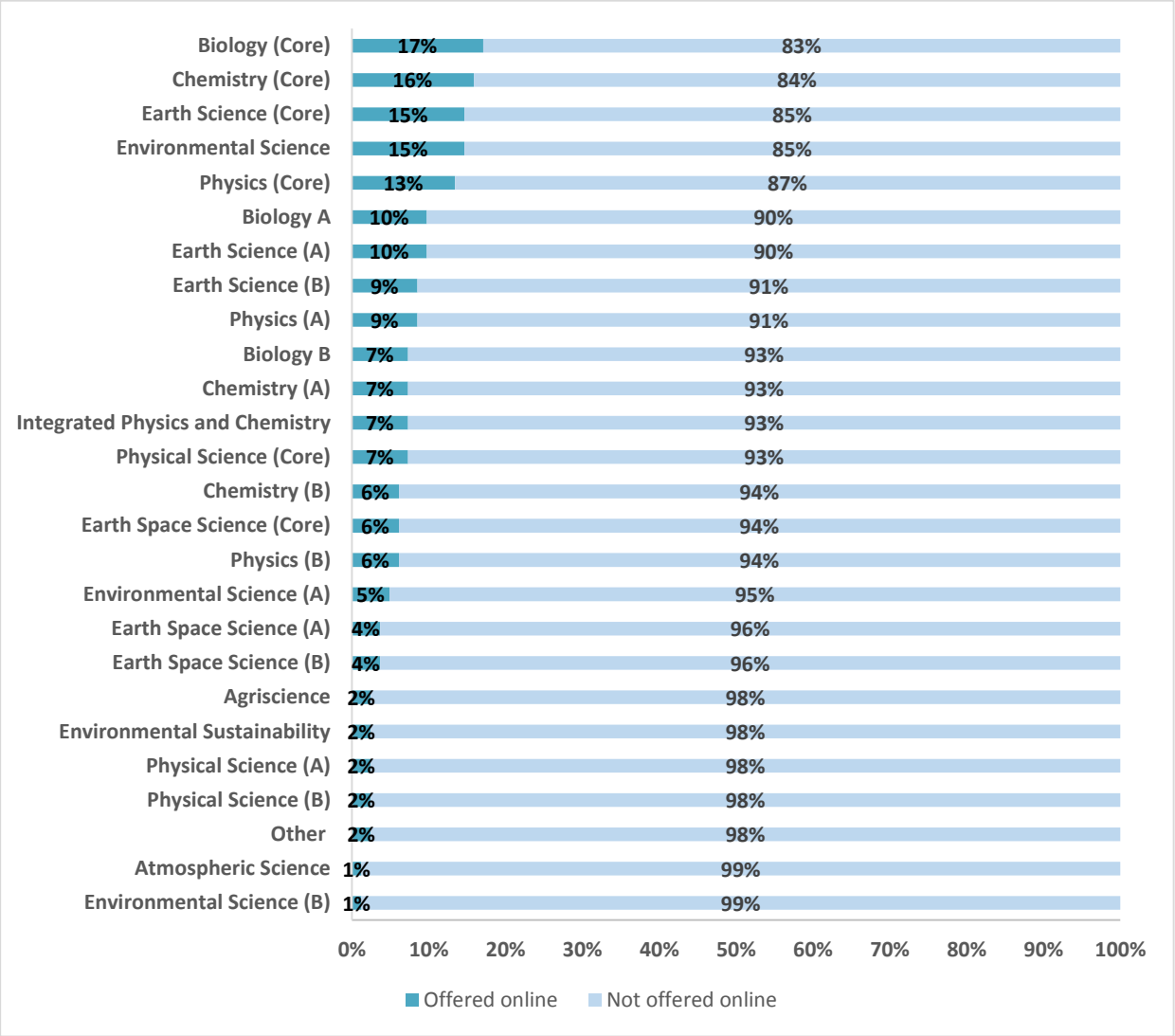


Note. Principals could select more than one answer choice for this survey item.

Principals indicated that for a majority of the online courses offered at their schools, grades 11 and 12 offered college credit (54% each grade level); grade 10 offered college credit for fewer online courses (17%), and none of the online courses offered at grade 9 provided students with college credit.

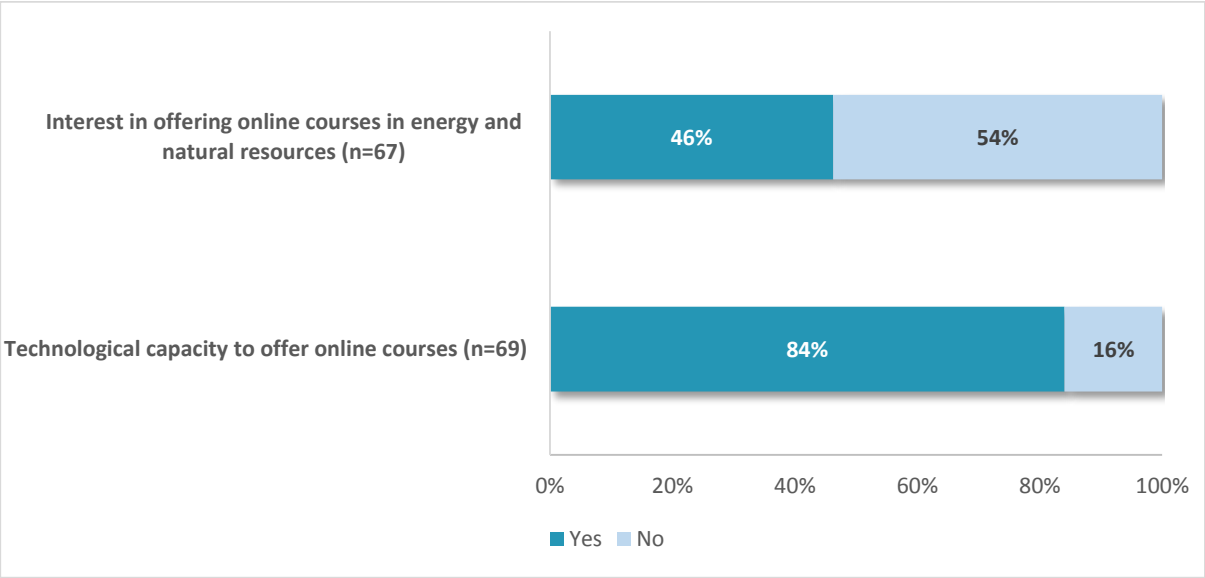
Next, principals were asked to identify all online high school courses offered in blended, traditional, or virtual schools. As can be seen in Figure 7, there is greater emphasis on online courses offered in the core courses of Biology, Chemistry, Earth Science, and Environmental Science.

Figure 7. Percent of Schools That Offer Online High School Courses, by Course



Principals in traditional and and blended schools were asked whether their school was interested in offering online courses in energy and natural resources to students and whether their schools had the technology capacity to offer online courses. Results reveal that a majority of traditional and blended schools have the technological capacity (84%) to offer online courses. Principals were, however, divided on their interest in offering such courses, as just 46% replied "yes" (see Figure 8).

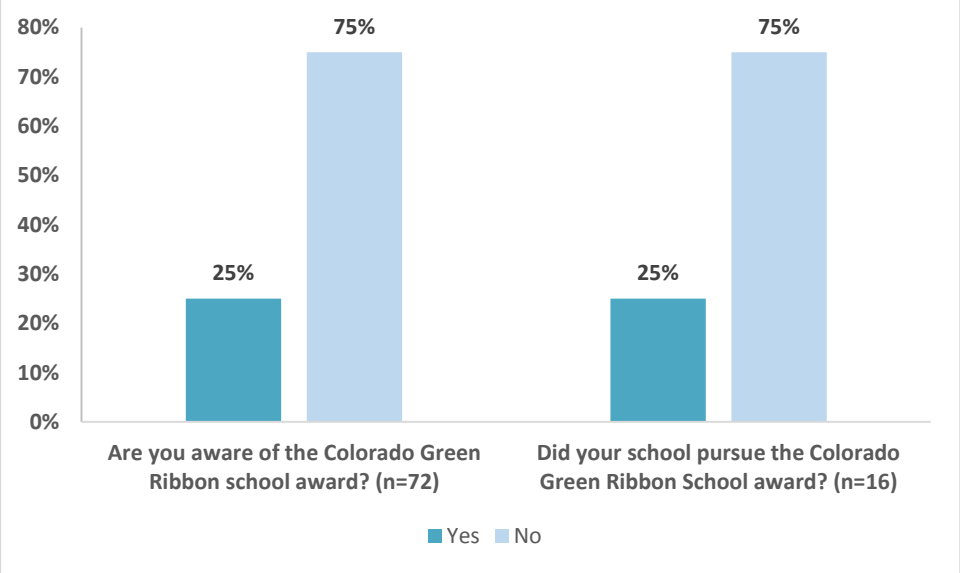
Figure 8. Traditional and Blended Schools' Technological Capacity and Interest in Offering Online Courses



All principals were asked whether they are aware of the Colorado Green Ribbon Schools award. According to the CDE website, a Green Ribbon Schools award represents a healthy and sustainable school and is recognized by stakeholders, such as parents, students, staff, and governments at federal, state and local levels, as an exemplary model of achievement in sustainability, health, and environmental education.

Those principals who replied in the affirmative were also asked whether their school has pursued this award (Figure 9). Most principals were not aware of such an award, and of those who indicated being aware of the Colorado Green Ribbon Schools award, very few pursued it.

Figure 9. Awareness and Pursuit of the Colorado Green Ribbon School Award



The last eight items in the survey were geared towards public charter and public magnet schools. Since none of the principals who completed the surveys were charter or magnet school principals, these survey items were not completed.

Conclusion

The principal survey revealed that public schools in Colorado have an interest in offering energy- and natural resources-related courses, notably in Atmospheric Science, Earth Space Science (core), Environmental Science A, Environmental Science B, Environmental Sustainability, Integrated Physics, and Chemistry. The majority of the courses are offered as electives, and principals indicated interest in offering such courses as supplemental resources to existing courses in their schools. Efforts in delivering teacher PD are focussed on core courses. Although interested in offering some of the energy- and natural resources-related courses, few schools indicated willingness to purchase such courses. Most online courses and college credits are offered at grades 11 and 12 in schools. As indicated in previous reports of this project, online courses are offered mostly in core courses such as Biology, Chemistry, and Earth Science. Environmental Science is also being offered online. The majority of traditional and blended schools have the technological capacity to offer online courses, but few indicated willingness to offer energy- and natural resources-related courses. Lastly, most public school principals in Colorado were not aware of the award that they can pursue to be recognized as a Colorado Green School.

Goal 3

Overview

Goal 3 of the Energy and Natural Resources project is to describe the status of online course offerings for high school students and the accreditation process.

Method

Internet Searches

The CDE's website contains descriptions of the online schools and programs currently offered in Colorado. These include multi-district online charter schools (n = 6), multi-district online schools (n = 22), single district online schools (n = 21), and single district online programs (n = 23). (See https://www.cde.state.co.us/onlinelearning/schools for a complete list.)

Inclusion Criteria

McREL examined the information on each school and program website. Appendix E provides a description of each school and program, including the school or program name, accreditation information, grades served, courses offered, and a link to the website of the school and program. Although all grades served at each school and program are listed in the Appendix E, course information is included only for grades 9–12.

Forty of 72 schools and programs that were examined are not included in the Appendix: 28 schools and programs did not have their curriculum listed on their website; four schools were elementary and/or middle schools; and eight programs did not have a working URL, and a Google search for the school or program did not yield any results.

Findings from Internet Searches

A total of 32 online schools and programs are presented in Appendix E. For the purpose of this report, researchers focused on energy- and natural resources-related courses offered by these high schools and programs geared toward high school students. Online schools and programs in Colorado offer a variety of courses related to energy and natural resources. The spectrum of classes offered are displayed in Table 6.

Table 6. Courses Related to Energy and Natural Resources Offered in Online Schools and Programs in Colorado, 2016.

Biology	Chemistry	Physics	Physical Science	Earth Space Science	Environmental Science	STEM Electives
Biology (Core)	General Chemistry	Physics (Core)	Physical Science (Core)	Earth Science (Core)	Environmental Science (AP)	Introduction to Agriscience
Biology A	Chemistry (Core)	General Physics I - Calculus Based	Physical Science (Coordinated)	Earth Science (Coordinated)	Environmental Science A (AP)	Integrated Physics and Chemistry A
Biology B	Analytical Chemistry	General Physics II	Physical Science (A)	Earth Science A	Environmental Science B (AP)	Integrated Physics and Chemistry B
Biology I	Chemistry A	Physics A	Physical Science (B)	Earth Science B	Environmental Science	Forensic Science
Biology II	Chemistry B	Physics B	Physical / Earth Science	Earth Space Science (Core)	Environmental Science A	Principles of Engineering (POE)
Biology (Comprehensive)	Chemistry (Comprehensive)	Physics (Comprehensive)	Physical Science (Comprehensive)	Earth Space Science A	Environmental Science B	Science Technology Lab
Biology (Honors)	Chemistry (Honors)	Physics (Honors)	Physical Science (Honors)	Earth Space Science B	Environmental Sustainability	Digital Electronics
Biology A (Honors)	Chemistry A (Honors)	Physics (AP)	Physical Science A (Honors)	Earth Science (Comprehensive)	IB Environmental Systems and Societies 11 & 12 SL	Essential Science
Biology B (Honors)	Chemistry B (Honors)	Physics I (AP)	Physical Science B (Honors)	Earth Science (Honors)	Natural Disasters	Science Research Seminar
Biology (AP)	Chemistry (AP)	Physics B (AP)	Accelerated Physical/Earth Science (IB/AP)	Earth Science A (Honors)		Green Design and Technology

Biology	Chemistry	Physics	Physical Science	Earth Space Science	Environmental Science	STEM Electives
Biology A (AP)	Accelerated Chemistry (IB/AP)	Physics C (AP)	Credit Recovery: Physical Science A & B	Earth Science B(Honors)		Science Internship
Biology B (AP)	IB Chemistry SL	AP Physics A-B		Earth Space Science (Honors)		
Accelerated Biology (IB/AP)		AP Physics B -C		Earth Space Science A (Honors)		
IB Biology 11 & 12 HL		Principles of Physics		Earth Space Science B (Honors)		
Life Science		IB Physics 11 & 12 SL		Atmospheric Science		
Credit Recovery: Biology A & B				Geology		
Ecology				Astronomy		
Colorado Ecology						

Conclusion

The spectrum of energy and natural resources-related courses in online schools and programs shows that the energy and natural resources content are embedded in the core courses and are also being offered through STEM elective and Environmental Science courses. Programs and schools which provided information about accreditation on their website mentioned being accredited by organizations such as AdvancED, CDE, regional accrediting organizations like the Council for Higher Education Accreditation, and the United States Department of Education.

Goal 4

Overview

Goal 4 of the Natural Resources project is to understand the policies of charter schools related to curriculum selection and use of online learning. The section below addresses Goal 4 of the project.

Method

Interviews

A phone interview was conducted with one staff member that represents the Colorado League of Charter Schools. The McREL researcher contacted the interviewee to schedule the interview at a time that was most convenient for the staff member. Prior to the interview, the purpose of the interview and the questions were e-mailed to the representative. The interview was conducted on April 26, 2016, and lasted approximately 30 minutes.

Protocol

The interview protocol was developed by McREL and included questions on charter school policies and practices for choosing curricula including selection and approval process for existing and new curricula, the league's recommendations for specific curricula, general process of curricula selection, and use of online learning in charter schools.

See Appendix F for the interview protocol.

Findings from Interviews

The interview findings presented below correspond with the questions in the interview protocol.

Selecting New Curricula and/or Making Modifications to Existing Curricula

The interviewee reported that at large charter schools, curricula selection and modification responsibilities are held by a director of curriculum and instruction and a chief academic officer. For smaller schools, the responsibility is held by the school leader, for example, a principal or executive director of the school. A business manager is also involved in the decision making to make sure that the proposal is financially feasible.

Approving New and/or Making Modifications to Existing Curricula

Once the discussions about selecting new curriculum or modifications to existing curriculum have occurred, a few options are presented to the charter school's governing board, and the governing board makes the final approval of any new curriculum selection or significant modification to the existing curriculum. The governing board at charter schools are a diverse group of community members who volunteer their time to support the charter school. Members typically include people from the fields of business, law, and marketing and communications, as well as individuals who are passionate about supporting a school in their local community. Typically board members serve three to five years on the governing board.

The Approval Process

The interviewee indicated that, depending on specific charter school staffing, the curriculum approval process may involve different individuals. For example, if the charter school has a director of curriculum and instruction, the director would be leading the effort. He/she collects data on the existing curriculum in question to find any gaps and then provides the rationale for replacing the existing curriculum. Thus, there are data collection and analysis research components to the approval process. The individual leading the effort can vary depending on the existing staffing model of a charter school.

Curriculum Recommendations

The League does not make recommendations for specific curriculum. They connect schools that are interested in certain curriculum with schools that are already using the curriculum. They can also identify curricula that may be a good fit for schools based on their own knowledge of curricula, but they don't endorse or recommend specific curricula.

General Process for Curriculum Selection

The interviewee indicated that charter schools often times reach out to other charter schools who are using the curriculum of interest to get more information. Thus, they collaborate and connect with each other to get curriculum-related information. They also reach out to the League to get information about the curriculum of interest. Lastly, they do independent research on the curriculum by talking to vendors directly and using online resources to find curriculum-related information.

Online Learning

The extent of online learning in charter schools is varied, according to the interviewee. The interviewee mentioned that there are charter schools in Colorado that are fully online, others are blended, and some use online learning minimally. Elaborating further, the interviewee mentioned that online usage is dependent on the individual school's mission and vision and their staffing model. Because many charter schools are small and have limited staff to support online courses, such courses tend to be electives.

Additional Comments

The interviewee mentioned that the League also maintains relationships with curriculum companies and vendors, although they don't endorse them. Curriculum companies attend the League's events and work with the League's member services to be involved in the charter school community. The interviewee mentioned that besides making sure that the curriculum selection/modification adheres to charter school's mission and vision, another deciding factor is the cost of the curriculum. Because charter schools have less funding than public schools, the League helps by occasionally pooling charter schools interested in a particular curriculum to make the price more affordable.

Conclusion

Overall, the interview revealed the basic criteria of charter schools in Colorado regarding the policies and practices related to choosing curricula. The governing board makes the final approval of any new curriculum selection or major modification to existing curriculum. Curriculum selection and modification is led by the director of curriculum and instruction and chief academic officer (for large schools) or by the principal or executive director of school (for small schools). A business manager is also involved in the process. The approval process involves data-driven decision making. While the League does not recommend any particular curriculum to charter schools, it does connect schools that are interested in a common curriculum for information sharing purposes. Charter schools collaborate with each other, get information directly from the vendors, and also reach out to the League to gather information about particular curricula. The extent of online learning in charter schools is varied, and online courses tend to be offered as electives. Charter schools' curriculum selection and/or modification is reliant on adhering to the mission and vision of the school as well as budget considerations.

Appendix A

Colorado and National Organizations That Offer PD in Science

Organization	Description	Link to organization
Citizen Science Academy	Provides online PD resources for educators to support effective implementation of Citizen Science projects and activities that focus on ecology and environmental sciences	http://citizenscienceacademy.org/
Colorado Association of Science Teachers (CAST)	Offers resources for science educators	http://www.coloradocast.org/
Colorado Science Education Network (CSEN)	Provides networking opportunities for leaders in science education across Colorado, provides PD, and addresses current issues facing science education and educators	http://coloradoscience.ning.com/
Colorado Education Initiative STEM	Foundation committed to STEM education	http://www.coloradoedinitiative.org/our-work/stem/
Colorado Experiential STEM Learning Network (CESLN)	Created by XSci and the University of Colorado Boulder, CESLN promotes ACTION-based STEM networking and integration. Its mission is to collaborate with schools, policy makers, and businesses in order to create extraordinary STEM experiences for students and teachers.	http://cesln.xsci.org/
The American Association for the Advancement of Science (AAAS)	An international non-profit organization dedicated to advancing science, engineering, and innovation around the world	http://www.aaas.org/
Annenberg Foundation	Annenberg's mission is to advance excellent teaching by funding and distributing multimedia resources for teachers (K–12 and college levels) to teach their subjects and to stay up to date in their fields.	http://www.learner.org/

Organization	Description	Link to organization
Intel® Education	Helps K–12 teachers of all subjects engage students with digital learning, including digital content, Web 2.0, social networking, and online tools and resources. Intel Teach Elements is a free, online PD series that helps teachers integrate technology effectively.	http://www.intel.com/content/www/us/en/education/k12/teach-elements.html
Khan Academy	Offers free, "world-class" online courses in math, science and engineering, arts and humanities, computing, and economics and finance.	https://www.khanacademy.org/
National Academies Press (NAP)	Created by the National Academy of Sciences to publish the reports of the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council	http://www.nap.edu/
National Aeronautics and Space Administration (NASA)	U.S. federal agency that is responsible for the nation's civilian space program and for aeronautics and aerospace research	http://www.nasa.gov/
National Science Education Leadership Association (NSELA)	Formed in 1959 to meet the need to develop science education leadership for K–16 school systems. Offers face-to-face training as well as free, online lesson plans and teaching materials supporting STEM curricula.	http://www.nsela.org/
National Renewable Energy Laboratory (NREL) Energy Institute for Teachers	Offers PD for middle and high school STEM teachers through its five-day Energy Institute for Teachers	http://www.nrel.gov/education/teachers.html
National Science Teachers Association (NSTA)	A member-driven organization that offers PD opportunities, and publishes books, journals, and additional content on effective teaching strategy and best practices	http://www.nsta.org/
PBS TeacherLine	Offers facilitated and self-paced online PD for PreK–12 educators	http://www.pbs.org/teacherline/
The National Science Foundation (NSF)	An independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…"	http://www.nsf.gov/

Organization	Description	Link to organization
Teaching Channel	A video showcase—on the Internet and TV—of inspiring and effective teaching practices in America's schools. We have a rapidly growing community of registered members who trade ideas and share inspiration from each other.	https://www.teachingchannel.org

Source: Colorado Department of Education, 2016.

Appendix B

AP Course Overview

Course	Description
Biology	Evolution, cellular processes (energy and communication), genetics, information transfer, ecology, and interactions
Chemistry	Atomic structure, intermolecular forces and bonding, chemical reactions, kinetics, thermodynamics, and equilibrium
Environmental Science	Earth system and resources, the living world, population, land and water use, energy resources and consumption, pollution, and global change
Physics 1	Kinematics, dynamics (Newton's laws, circular motion and universal law of gravitation), simple harmonic motion (simple pendulum and mass spring systems, impulse, linear momentum, and conservation of linear momentum), collisions, work, energy, and conservation of energy, rotational motion, torque, rotational kinematics and energy, rotational dynamics, and conservation of angular momentum, electrostatics (electric charge and electric force), DC circuits (resistors, mechanical waves and sound).
Physics 2	Thermodynamics: laws of thermodynamics, ideal gases, and kinetic theory, fluid statics and dynamics, electrostatics (electric force, electric field and electric potential), DC circuits and RC circuits (steady state only), magnetism and electromagnetic induction, geometric and physical optics, quantum physics, atomic, and nuclear physics
Physics C: Electricity and Magnetism	Electrostatics, conductors, capacitors, dielectrics, electric circuits, magnetic fields, electromagnetism
Physics C: Mechanics	Kinematics, Newton's laws of motion, work, energy, power, systems of particles, linear momentum, circular motion and rotation, oscillations and gravitation

Note. AP Physics B course has been replaced by AP Physics 1: Algebra based and AP Physics 2: Algebra based.
Source: The College Board, 2015.

Appendix C

Interview Protocol

Thank you for agreeing to participate in this interview. The Colorado Energy Office (CEO) engaged McREL International to examine current high school teacher professional development and student learning opportunities offered in Colorado through a combination of surveys and interviews with stakeholders. This interview is expected to last around 30 minutes and will be audio recorded so it can be transcribed. Do I have your permission to record? [Record, if yes. If no, take notes]. Audio files will be kept in a secure place during the study and destroyed at the end of the study. There is minimal risk of identification as I am interviewing only you at your organization, but comments in the report will be aggregated across organizations. If responses are quoted verbatim, quotations will not include your name. Your participation is voluntary—you may choose not to answer any particular question, and you may end the interview at any time without penalty. The benefits of your involvement in this evaluation include the opportunity to share your experiences with the Colorado Energy Office and providing valuable information to CEO which will aid them in making important decisions about natural resources course offerings and teacher PD at the high school level in Colorado.

The interview is focused on two major topics:

- High school student learning opportunities in natural resources courses
- Current Colorado professional development for teachers in natural resources

Natural resources courses can be in fields like oil and gas, mining, state lands, water conservation and resources, environmental science, renewable energy, and atmospheric sciences.

1. How do you think K–12 approaches natural resources education? For example, is it a presentation of a) facts about the natural resources and their processes, b) implications for economics and policies, and/or c) diverse view points on approaches and policies, with a goal of synthesizing information to come up with the best approach?

2. To your knowledge, what is the current landscape of course offerings (in natural resources apart from the required biology, chemistry, and physics courses) among Colorado high schools? (E.g., are course offerings in these fields commonplace or only in specialized contexts?)

3. Are there specific programs or organizations that provide natural resources education support or programs for high school teachers in Colorado?

(Follow-up: Is professional development offered at the state level? District level? School level?)

4. Are there any out-of-school time courses being offered in these fields for Colorado high school students?

5. What is the accreditation process for such courses?

6. Do you think there is an interest among schools in Colorado for purchasing courses/curriculum related to natural resources education? (E.g., AP Environmental Science)

7. Do schools in Colorado have the staffing and technological capacity to offer courses in natural resources online?

8. What are the policies and practices related to choosing curricula in magnet and charter public schools in Colorado? Is there a specific process for choosing environmental/natural sciences curricula?

Appendix D

Principal Survey

Q1 The Colorado Energy Office (CEO) is interested in studying Science Technology Engineering and Math (STEM) education across Colorado's secondary education institutions with a focus on how it addresses energy industry workforce needs. In support of this effort, you are invited to participate in this short survey. This survey asks you questions to gain insights into what is currently being done in Colorado schools related to natural resources and energy based education for high school students and to gauge schools' interest in offering such education in the classroom and/or online. The survey will take you approximately 10 minutes to complete. There are no anticipated direct benefits to you for participating in this survey, but we anticipate the findings will be used to support Colorado schools in preparing high school students to enter STEM fields. The reports prepared will summarize findings and will not associate responses with a specific individual; direct quotes will not be included in the reports. Your participation in completing this survey is voluntary, and because it is anonymous and questions are not of a sensitive nature, no known risks are associated with completing this survey. You may choose to not answer any particular question or stop completing the survey at any time. If you have any questions about your participation in this survey, please contact Dr. Katie Stringer, director of research at McREL International (McREL), at 303-632-5567 or kstringer@mcrel.org. If you have any questions about your rights as a participant, please contact Karen Bumgardner, at 303-347-1841 or kbumgardner@mcrel.org. By clicking the forward arrows and completing this survey, you are consenting to complete the survey as part of CEO's work with McREL International.

Q2 Please select your school name from below:

List of school names

Q3 The questions that follow are about high school grade levels (grades 9-12) only.

Q4 Is your school:

traditional (face-to-face instruction)
blended
online (virtual)

Q5 Is your school:

Public
Public Charter
Public Magnet
Private
Neither Charter nor Magnet
Other, please describe _____

Q6 Does your school have a STEM focus?

Yes
No

Q7 For the following list of natural resources-related courses, please indicate the status of the course in your school:

	Currently offering	Not currently offering but interested	No interest in offering
Agriscience			
Atmospheric Science			
Biology (Core)			
Biology A			
Biology B			
Chemistry (Core)			
Chemistry (A)			
Chemistry (B)			
Earth Science (Core)			
Earth Science (A)			
Earth Science (B)			
Earth Space Science (Core)			
Earth Space Science (A)			
Earth Space Science (B)			
Environmental Science			
Environmental Science (A)			
Environmental Science (B)			
Environmental Sustainability			
Integrated Physics and Chemistry			
Physics (Core)			
Physics (A)			
Physics (B)			
Physical Science (Core)			
Physical Science (A)			
Physical Science (B)			

Q8 For the following list of natural resources-related courses, please indicate if they are being offered as an elective and/or Out-of-School Time (OST) programs in your school that supports the content.

	Elective	Out-of-School Time Program
Agriscience		
Atmospheric Science		
Biology (Core)		
Biology A		
Biology B		
Chemistry (Core)		
Chemistry (A)		
Chemistry (B)		
Earth Science (Core)		
Earth Science (A)		
Earth Science (B)		
Earth Space Science (Core)		
Earth Space Science (A)		
Earth Space Science (B)		
Environmental Science		
Environmental Science (A)		
Environmental Science (B)		
Environmental Sustainability		
Integrated Physics and Chemistry		
Physics (Core)		
Physics (A)		
Physics (B)		
Physical Science (Core)		
Physical Science (A)		
Physical Science (B)		

Q9 Are there other energy and natural resources-related courses not listed above, that your school currently offers?

Q10 For the following courses do teachers at your school, get specialized training/professional development? Please select all courses that apply.

Agriscience
Atmospheric Science
Biology (Core)
Biology A
Biology B
Chemistry (Core)
Chemistry (A)
Chemistry (B)
Earth Science (Core)
Earth Science (A)
Earth Science (B)
Earth Space Science (Core)
Earth Space Science (A)
Earth Space Science (B)
Environmental Science
Environmental Science (A)
Environmental Science (B)
Environmental Sustainability
Integrated Physics and Chemistry
Physics (Core)
Physics (A)
Physics (B)
Physical Science (Core)
Physical Science (A)
Physical Science (B)

Q11 In addition to the current courses offered at my school, I am interested in providing…

stand-alone courses related to energy and natural resources at my school
supplemental resources for existing courses related to energy and natural resources at my school
none of the above choices related to energy and natural resource courses at my school

Q12 If your school had to pay for any of the energy and natural resources-related courses in which you are interested, would you be willing to purchase the course(s)?

Yes
No

Answer If Is your school: blended Is Selected Or Is your school: traditional (face-to-face instruction) Is Selected

Q13 Does your school offer online course(s)?

Yes
No

Answer If Does your school offer online course(s)? Yes Is Selected Or Is your school: online (virtual) Is Selected

Q14 Please select the high school grade levels at which your school offers online courses.

9
10
11
12

Answer If Does your school offer online course(s)? Yes Is Selected Or Is your school: online (virtual) Is Selected

Q15 Does the online course at these grade level(s) offer college credit?

	Yes	No
Grade 9		
Grade 10		
Grade 11		
Grade 12		

Answer If Is your school: online (virtual) Is Selected Or Does your school offer online course(s)? Yes Is Selected

Q16 Please select all the high school courses that your school offers online.

- Agriscience
- Atmospheric Science
- Biology (Core)
- Biology A
- Biology B
- Chemistry (Core)
- Chemistry (A)
- Chemistry (B)
- Earth Science (Core)
- Earth Science (A)
- Earth Science (B)
- Earth Space Science (Core)
- Earth Space Science (A)
- Earth Space Science (B)
- Environmental Science
- Environmental Science (A)
- Environmental Science (B)
- Environmental Sustainability
- Integrated Physics and Chemistry
- Physics (Core)
- Physics (A)
- Physics (B)
- Physical Science (Core)
- Physical Science (A)
- Physical Science (B)
- Other energy and natural-resources related course, please specify _____

Answer If Is your school: traditional (face-to-face instruction) Is Selected Or Is your school: blended Is Selected

Q17 Is your school interested in offering online courses in energy and natural resources to students?

- Yes
- No

Answer If Is your school: traditional (face-to-face instruction) Is Selected Or Is your school: blended Is Selected

Q18 Does your school have the technological capacity to offer online courses to students?

Yes
No

Q19 Are you aware of the Colorado Green Ribbon school award?

Yes
No

Answer If Are you aware of the Colorado Green Ribbon school award? Yes Is Selected

Q20 Did your school pursue the Colorado Green Ribbon School award?

Yes
No

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q21 Does your school board/advisory board/board of directors approve new curricula?

Yes
No

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q22 What is the process for approving curricula?

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q23 Does your school board/advisory board/board of directors make modifications to existing curricula?

Yes
No

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q24 What is the process for making modifications to existing curricula?

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q25 How is curricula in your school generally chosen?

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q26 Who is responsible at your school for selecting and approving curricula? Please select all that apply.

Principals		
Other administrators (e.g. Assistant Principals, Academic Dean)		
Teachers		
Parents		
Students		
Community members		
Other, please specify		

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q27 Does your school use online learning?

Yes
No

Answer If Is your school: Public Charter Is Selected Or Is your school: Public Magnet Is Selected

Q28 Please select for which of the following purposes your school uses online learning?

Elective courses (Non-Advanced Placement)
Core courses (Non-Advanced Placement)
Advanced Placement courses
Remediation courses
Other, please specify _____

Appendix E

Multi-District Online Charter Schools

1. College Pathways

Accreditation

This Colorado public school has accreditation though Academy School District 20 (ASD20), Infinite Campus data is shared with both ASD20 and the CDE. All students at the Classical Academy (TCA) must have records in Infinite Campus.

Grades Served: 7–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics A • Physics B • Earth Science A • Earth Science B

School website: http://www.edline.net/pages/TCA_College_Pathways

2. Colorado Virtual Academy (COVA)

Accreditation

[No accreditation found]

***Grades Served*:** 9–12

Selected Courses

• Biology Core • Chemistry Core • Earth Science Core • Physical Science Core • Biology Comprehensive • Chemistry Comprehensive • Earth Science Core • Biology Honors • Chemistry Honors • Physics Honors • Earth Science Honors

• Biology AP • Chemistry AP • Physics AP • Environmental Science AP

School website: http://cova.coloradoed.org/

3. Elevate Academy

Accreditation

[No accreditation found]

***Grades* Served:** 7–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physical Science Core • Biology Honors • Chemistry Honors

• Physics Honors • Physical Science Honors • Earth Space Science Honors • Biology AP • Environmental Science AP

• Marine Science

School website: http://elevate.coloradoed.org/

4. Guided Online Academic Learning (GOAL) Academy

Accreditation

[No accreditation found]

***Grades Served*:** 9–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics A • Physics B • Earth Science A • Earth Science B

• Integrated Physics and Chemistry A • Integrated Physics and Chemistry B

School website: http://www.goalac.org/

5. Hope Online Learning Academy CO-OP

Accreditation

The curriculum is accredited, standards based, and mapped to the national Common Core and Colorado standards.

Grades Served: K–12

Selected Courses

[No course list found]

School website: http://www.hopeonline.org/

Multi-District Online Schools

1. Academy Online High School – Extended Studies

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Analytical Chemistry • General Physics I – Calculus Based • Environmental Science AP

School website: http://www.asd20.org/schools/aohs/Pages/default.aspx

2. Academy Online High School – The Access Program

Accreditation

[No accreditation found]

Grades Served

Grades 10–12

Selected Courses

• Biology Core • Chemistry Core • Earth Science Core • Physical Science Core • Biology AP • Chemistry AP • Physics AP • Physics 1 AP • Physics 2 AP • Physics C AP • Environmental Science AP • Environmental Science

School website: http://www.asd20.org/schools/aohs/Pages/default.aspx

3. Boulder Universal

Accreditation

Boulder universal is accredited with the CDE.

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physical Science Core • Biology AP • Physics AP • Environmental Science AP

School website: http://bou.bvsd.org/Pages/default.aspx

4. Branson School Online

Accreditation

[No accreditation found]

Grades Served: K–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physical Science Core • Earth Space Science Core • Introduction to Agriscience

School website: http://www.bransonschoolonline.com/

5. Colorado Connections Academy

Accreditation

Connections Academy is a division of Connections Education LLC, which is accredited by AdvancED, the national accreditation commission that represents twenty-seven thousand public and private schools and districts across the United States and in sixty-five countries worldwide. Many of the Connections Academy schools are also accredited by one or more of six regional accrediting organizations for higher education institutions recognized by the Council for Higher Education Accreditation and the United States Department of Education. Their new schools typically begin the accreditation process after operating for a full year.

Grades Served: K–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics A • Physics B • Physical Science A • Physical Science B

• Earth Space Science A • Earth Space Science B • Biology A Honors • Biology B Honors • Chemistry A Honors

• Chemistry B Honors • Earth Science A Honors • Earth Science B Honors • Physical Science A Honors • Physical Science B Honors • Earth Space Science A Honors • Earth Space Science B Honors • Biology A AP • Biology B AP • Environmental Science A AP • Environmental Science B AP

School website: http://www.connectionsacademy.com

6. Colorado Preparatory Academy (CPA)

Accreditation

Colorado Preparatory Academy is accredited by AdvancED.

Grades Served: K–12.

Selected Courses

• Biology Core • Chemistry Core • Earth Science Core • Physical Science Core •Biology Comprehensive • Chemistry Comprehensive • Physical Science Comprehensive • Earth Science

Comprehensive • Biology Honors • Chemistry Honors • Physics Honors • Earth Science Honors • Biology AP • Chemistry AP • Environmental Science AP • Introduction to Agriscience • Environmental Science • Astronomy • Forensic Science • Science Research Seminar

School website: http://cpa.k12.com

7. Denver Online High School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Biology Honors • Chemistry Honors • Physics Honors

School website: http://online.dpsk12.org/

8. eDCSD Colorado Cyber School

Accreditation

[No accreditation found]

Grades Served: K–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Earth Science Core

School website: https://www.dcsdk12.org/school/edcsd/

9. Engage Online Academy

Accreditation

Engage is a fully accredited K-12 school. Additional details about accreditation are not mentioned.

Grades Served

Grades K–12

Selected Courses

• Chemistry Core • Earth Science Core

School website: http://www.greeleyschools.org/domain/2726

10. Jeffco's 21st Century Virtual Academy

Accreditation

[No accreditation found]

Grades Served: K–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physics 1 AP • Physics C AP • Environmental Science AP

School website: http://www.jeffcopublicschools.org/online/

11. Monte Vista Online Academy

Accreditation

Mote Vista Online Academy (OLA) is a diploma-granting educational entity certified by the CDE as a public online high school (certification #MD013-08, public school #6520).OLA is fully accredited by CDE through the Monte Vista School District.

Grades Served: 4–12

Selected Courses

• Biology I • Biology II • General Chemistry • Physics Core • Earth Science Core • Physical Science Core

• Environmental Science

School website: http://www.mvola.org/

12. Mountain View Virtual

Accreditation

EdisonLearing eCourses® are accredited by the Northwest Accreditation Commission (NWAC) of AdvancED, are aligned to State standards, and are designed to fit graduation requirements for Colorado.

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Earth Science Core • Environmental Science • Natural Disasters

School website: http://mountainviewvirtual.com/

13. PSD Global Academy

Accreditation

[No accreditation found]

Grades Served

Grades K–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physical Science Core • Biology AP • Chemistry AP • Physics B AP

• Environmental Science AP • Environmental Science

School website: https://pga.psdschools.org/

14. Rocky Mountain Digital Academy

Accreditation

[No accreditation found]

Grades Served: 6–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics A • Physics B • Earth Science Coordinated • Earth Science A • Earth Science B • Physical Science Coordinated • Integrated Physics and Chemistry A • Integrated Physics and Chemistry B

School website: http://rmdac.org/

15. Springs Studio for Academic Excellence

Accreditation

IHA -R Basic Instructional Program: These regulations specify the conditions and procedures under which the District may achieve accreditation.

Grades Served: K–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Earth Science Core • Physical Science Core • Introduction to Agriscience • Green Design and Technology • Science Internship

School website: http://www.jeffcopublicschools.org/online/

16. Southwest Colorado eSchool (San Juan BOCES)

Accreditation

[No accreditation found]

Grades Served: 7–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physics 1 AP • Physics C AP • Environmental Science AP

• Environmental Science

School website: http://www.southwestcoloradoeschool.org/

Single District Online Schools

1. Pueblo County High School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology 1 • Chemistry Core • Physics Core • Physical/Earth Science • Physical/Earth Science Honors • Biology AP

• Chemistry AP • Physics AP • Environmental Science • Environmental Sustainability • Principals of Engineering (POE)

• Science Technology Lab • Digital Electronics

Link to school website: http://pch.district70.org/

2. School of Engineering and Biomedical Science (PCHS – SEBS)

Accreditation

[No accreditation found]

Grades Served

Grades 9–12

Selected Courses

• Chemistry • Physics • Biology Honors • Physical Science Honors

School website: http://sebs.district70.org/

3. Pueblo West High

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology 1 • Chemistry Core • Physical/Earth Science • Biology AP • Chemistry AP • Physics AP • Geology

• Environmental Science • Astronomy • Accelerated Physical/Earth Science (IB/AP) • Accelerated Biology IB/AP

• IB Chemistry SL • IB Environmental systems and Societies 11 and 12 SL • Botany • Zoology • Essential Science

• Principals of Physics • IB Physics 11 and 12 SL

School website: http://pwh.district70.org/

4. Rye High School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Earth Science • Physical Science Core • Life Science

School website: http://ryh.district70.org/

5. Bolt Academy

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics A • Physics B • Physical Science A • Physical Science B

• Environmental Science A • Environmental Science B • Astronomy •Credit Recovery: Physical Science A and B • Credit Recovery: Biology A and B

School website: http://www.sd27j.org/bolt

6. St. Vrain Online Global Academy

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physical Science Core • Earth Space Science Core • Biology Honors

• Chemistry Honors • Physics Honors • Physical Science Honors • Earth Space Science Honors • Marine Science Honors • Biology AP • Environmental Science AP • Marine Science

School website: http://svoga.svvsd.org/

Single District Online Programs

1. Mesa Ridge High School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Earth Science Core • Physical Science Core • Biology Honors

• Chemistry Honors • Human Physiology Honors • Biology AP • Chemistry AP • Physics AP • Environmental Science AP • Astronomy AP • Ecology

School website: http://www.wsd3.org/Page/379

2. Adams City High School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology A • Biology B • Chemistry A • Chemistry B • Physics Core • Earth Science Core • Physical Science Core

• Biology A Honors • Biology B Honors • Chemistry A Honors • Chemistry B Honors • Earth Science Honors • Physical Science Honors • Biology AP • Chemistry AP • AP Physics A-B • AP Physics B-C • Forensic Science • Colorado Ecology • Microbiology

School website: http://adamscityhigh.adams14.org/

3. North Conejos Alternative Program (N. Conejos)

Accreditation

[No accreditation found]

Grades Served: K–12

Selected Courses

• Biology Core • Earth Science Core • Physical Science Core

School website: http://north.co.schoolwebpages.com/

4. RHS Online School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Earth Science Core • Environmental Science

School website: http://roosevelt.weldre5j.edlioschool.com

5. Weld Central Online School

Accreditation

[No accreditation found]

Grades Served: 9–12

Selected Courses

• Biology Core • Chemistry Core • Physics Core • Physical Science Core • Environmental Science • Environmental Science AP

School website: http://wchs.re3j.com/modules/cms

Appendix F

Interview Protocol

Thank you for agreeing to participate in this interview. The Colorado Energy Office (CEO) engaged McREL International to examine, through a combination of surveys and interviews with stakeholders, current energy- and natural resources-based high school student learning opportunities offered in Colorado, and to understand the policies of charter schools related to curriculum selection and use of online learning. This interview is expected to last around 30 minutes and will be audio recorded so it can be transcribed. Do I have your permission to record? [Record, if yes. If no, take notes]. Audio files will be kept in a secure place during the study and destroyed at the end of the study. There is minimal risk of identification, as I am interviewing only you at your organization; if responses are quoted verbatim, quotations will not include your name. Your participation is voluntary—you may choose not to answer any particular question, and you may end the interview at any time without penalty. The benefits of your involvement in this evaluation include the opportunity to share your experiences with the Colorado Energy Office and provide valuable information to CEO which will aid them in making important decisions about natural resources course offerings and teacher PD at the high school level in Colorado.

The interview is focused on two major topics related to Colorado high schools:

- Charter school policies and practices for choosing curricula
- Use of online learning in charter schools

1. Who is responsible at charter schools for selecting new curricula and/or making modifications to existing curricula (e.g., principals, assistant principals, teachers, parents, students, community members)?

2. Who approves new curricula and/or makes modifications to existing curricula?

3. What is the process for approving curricula?

4. Does the Colorado League of Charter Schools make recommendations for specific curricula (e.g., Environmental Science?)
   [Follow up: What is the process for vetting such curricula?]

5. Does the approving body also make modifications to existing curricula?

6. What is the process for making modifications to existing curricula?

7. How are curricula in charter schools generally chosen?

8. For what purposes do charter schools use online learning (e.g., elective courses non-AP, core courses non-AP, AP courses, remediation courses, other)?

9. In your opinion, are charter schools more, less, or equally likely to choose to adopt natural resources- and energy-focused curricula or supplements to curricula? Please explain your response.

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